dsDNA to enter during packaging and to exit during infection. The connector inserted in lipid bilayer exhibits robust properties and generates extremely sensitive conductance signatures. DNA and RNA can be electrophoretically driven through the channel in a concentration and voltage dependent manner. Information about the structure, length and conformational dynamics can then be deduced by their characteristic dwell times during translocation and by their relative percentage in current blockades. This motor channel further exercises a one-way traffic property for dsDNA translocation from N- to C-terminal with a natural valve mechanism in DNA-packaging. We also demonstrated its utility as a highly sensitive device for capture and fingerprinting of chemicals and biopolymers in real time at extremely low concentrations and in the presence of many contaminants. The phi29 motor channel has potential applications in high-throughput single-pore DNA sequencing, environmental surveillance, athlete drug monitoring, toxin/drug screening, and earlier disease diagnosis.
Supporting publications from Guo lab: (1) *Nature Nanotechnology*. 2009. 4: 765; (2) *Nano Letters.* 2010, 10: 3620; (3) *Molecular Biosystems*. 2010. 6:1844 (4) *Biomaterials.* 2011. 32:8234; (5) *Biophysical Journal.* 2012. 102:127; (6) *ACS Nano.* 2012. 6:3251; (7) *Nature Protocols.* 2013. 8:373; (8) *Nano Today.* 2013. 8:56; (9) *ACS Nano*. 2013. 7:9814.

2431-Pos Board B568
Single Molecule Nucleic Acid Sensing in an Optical Nanopore Array
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By optically encoding the Ca^{2+} flux we are able to parallelize the detection of nucleic-acid binding events in nanopores. We report parallel recordings at a density of ~ 10k measurements per square milimeter in a single droplet hydrogel bilayer (DHB). Both static DNA blockage and kinetic miRNA unzipping events can be monitored optically for single molecule nucleic acid identifications. Sub-pA equivalent amplitude resolution and 3 ms temporal resolution is demonstrated, which enables discrimination between nucleic acids with 1-4 bases difference. To further expand this platform, hydrogel hydrogel bilayer array (HHBa) is formed with micro-patterned hydrogel chip, which is also compatible with a spotting robot for biological screening applications. Based on the enzymatic ratchet speed (~35 Hz), this optical recording platform should produce sequencing signal with a rate of 1 million nucleotides per square milimeter per second, which paves the way to 15 minutes human genome sequencing and other general applications of single molecule sensing with nanopores.

2432-Pos Board B569
An ATR-FTIR based Immuno-Biosensor for the Detection and Analysis of Disease Related Biomarkers from Liquid Samples
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The research and detection of biomarker candidates and their structural information analysis have become clinically important during the last decades. Especially neurodegenerative disorders like Alzheimer's or Parkinson disease are characterized by misfolding of body-own proteins into oligomeric and fibrillar ß-sheet enriched higher-level clusters. According to the detection of specific biomarkers in complex media, enzyme-linked immunosorbent assays (ELISA) demonstrate a high specificity and are sensitive to minute peptide amounts. On the other hand, FTIR spectroscopy has been proved to be quite useful for the detection and analysis of protein secondary structures and conformational changes during disease progression. Particular the attenuated total reflection (ATR) technique has been provided, due to its possibility for surface modification, the selective detection of soluble membrane anchored disease related proteins. Thus, secondary structure analysis of various disease related proteins like Prion Protein (PrP) or Amyloid-beta- (Aß) is achieved.
Here, we demonstrate an ATR-FTIR based biosensor that combines the advantages of both ELISA and FTIR. Thus, we achieve the maximum specificity with simultaneous structure sensitivity in one sensor. Thereby disease related proteins like Amyloid-beta or alpha-synuclein were detected in complex solutions like *cerebrospinal fluid* or blood plasma. The determined secondary structure gave information concerning disease state or progression. However, the immuno-biosensor demonstrates the potential of the FTIR-spectroscopy in the biomedical sector.

2433-Pos Board B570
Slowing Down DNA Translocation and Neutral Single Molecules Detection through Solid-State Nanopores by Pressure
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Charged single molecules of DNA can be detected and characterized with a voltage-biased solid-state nanopore immersed in an electrolyte solution. This has stimulated intense research towards understanding and utilizing this nanosensor device for the analysis of a wide variety of charged polymer molecules, and for the ultimate goal: DNA sequencing. As one of its fundamental challenges, DNA translocation speed through solid-state nanopores (~30 base/us) is too fast for instruments to "read" each base signal compared to their protein counterparts. By taking advantage of the ability of solid-state membranes to sustain large pressure drops without breaking, we show here that a pressure-induced fluid flow, in and near the nanopore, provides an additional force to control the motion of the molecule through the pore. This pressure-derived force, combined with the voltage bias, enables solid-state nanopores to detect and characterize very short molecules, and near-neutral molecules. For uniformly charged polymers like DNA, the pressure-derived force can be countered by the voltage-derived force to slow the molecule motion without reducing the ionic current signal. Modest pressures applied to a voltage-biased nanopore greatly extend their utility as single molecule detectors by enabling neutral molecule capture and detection, as well as control of molecule translocation speeds through the pore. We demonstrate nearly an order-of-magnitude improvement in length discrimination. This broader range of detectable molecule sizes, charge states, and spatial conformations considerably expands the applicability of nanopore detection technologies.

2434-Pos Board B571
A Next Generation Label-Free PoC Sensing Platform
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Current Point-of-Care Testing (PoCTs) or biomarkers are affinity based and require immobilisation on the substrate for sensitive detection. This not only increases the production and overall costs but also introduce measurement error leading to false interpretations. The PoCT devices are well established for protein and cell based assays but challenges remain for label-free, inexpensive and multiplex protein screening tools. Nanopore sensing allows detection of biomolecular interactions and intramolecular structural alterations. It monitors ionic currents changes when a charged molecule translocates through the pore with external electric potential. The ultimate advantage is removing the clouding of ensemble averaging.
There are two types of nanopores, biological and solid-state which both efficiently probe analytes at the single molecule level but they either have limitation on pore diameter or required very expensive equipment to fabricate the pore. Here we employ a conical solid-state nanopore - nanopipettes (sub-nanometer size) to screen through different targets. They are quicker and cheaper to fabricate and can select the optimum pore diameter. The material of nanopipette (quartz) have low electrical noise which would be ideal to differentiate the binding signal with the complex. Traditional assays use antibodies because of high specificity and selectivity however they are difficult to implement onto the nanopipette due to relatively large size and hydrodynamic complexity in the nanochannels. Distinguishing between binding and transient blockade remains unresolved. Aptamers are single-stranded oligonucleotides which bind to relevant target molecules with high affinities similar to antibodies but are more robust, smaller in size and cost effective.
Due to the specificity of the aptamers, integrating with nanopipette will allow single protein molecules to be detected to in a low cost, label-free manner and able to screen targets in a high-throughput format leading to next generation PoC electrochemical sensing platforms for screening proteins.

2435-Pos Board B572
Real-Time Detection of Lipid Bilayer Assembly and Detergent-Initiated Solubilization
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The cellular membrane governs numerous fundamental biological processes, and therefore, developing a comprehensive understanding of its structure and function is critical. However, because of its inherent complexity, this challenge is as yet unsolved. In an attempt to develop a model, two different experimental approaches are being pursued in parallel: performing single cell experiments (top down) and using biomimetic structures (bottom up), such as lipid bilayers. One challenge in many of these experiments is the reliance on fluorescent probes for detection. In the present work, we have used a label-free detection method based on an evanescent optical sensor known as an optical resonant cavity. In this approach, we are able to detect the self-assembly and solubilization of lipid bilayers in real-time. Specifically, using these silica devices, there are two independent detection mechanisms which are able to confirm the formation and detergent assisted solubilization of the lipid bilayers: 1) a refractive index change and 2) a material loss change. Both mechanisms can be monitored in parallel, on the same device, thus allowing for cross-confirmation of the results. To verify the proposed method, we have detected the formation of self-assembled phosphatidylcholine lipid bilayers from SUVs on the device surface